

fuel during normal operation, and any other tank that normally supplies fuel to the engine alone contains usable fuel.

[Amdt. 27-23, 53 FR 34212, Sept. 2, 1988]

**§ 27.959 Unusable fuel supply.**

The unusable fuel supply for each tank must be established as not less than the quantity at which the first evidence of malfunction occurs under the most adverse fuel feed condition occurring under any intended operations and flight maneuvers involving that tank.

**§ 27.961 Fuel system hot weather operation.**

Each suction lift fuel system and other fuel systems with features conducive to vapor formation must be shown by test to operate satisfactorily (within certification limits) when using fuel at a temperature of 110 °F under critical operating conditions including, if applicable, the engine operating conditions defined by § 27.927 (b)(1) and (b)(2).

[Amdt. 27-23, 53 FR 34212, Sept. 2, 1988]

**§ 27.963 Fuel tanks: general.**

(a) Each fuel tank must be able to withstand, without failure, the vibration, inertia, fluid, and structural loads to which it may be subjected in operation.

(b) Each fuel tank of 10 gallons or greater capacity must have internal baffles, or must have external support to resist surging.

(c) Each fuel tank must be separated from the engine compartment by a firewall. At least one-half inch of clear airspace must be provided between the tank and the firewall.

(d) Spaces adjacent to the surfaces of fuel tanks must be ventilated so that fumes cannot accumulate in the tank compartment in case of leakage. If two or more tanks have interconnected outlets, they must be considered as one tank, and the airspaces in those tanks must be interconnected to prevent the flow of fuel from one tank to another as a result of a difference in pressure between those airspaces.

(e) The maximum exposed surface temperature of any component in the fuel tank must be less, by a safe mar-

gin as determined by the Administrator, than the lowest expected autoignition temperature of the fuel or fuel vapor in the tank. Compliance with this requirement must be shown under all operating conditions and under all failure or malfunction conditions of all components inside the tank.

(f) Each fuel tank installed in personnel compartments must be isolated by fume-proof and fuel-proof enclosures that are drained and vented to the exterior of the rotorcraft. The design and construction of the enclosures must provide necessary protection for the tank, must be crash resistant during a survivable impact in accordance with § 27.952, and must be adequate to withstand loads and abrasions to be expected in personnel compartments.

(g) Each flexible fuel tank bladder or liner must be approved or shown to be suitable for the particular application and must be puncture resistant. Puncture resistance must be shown by meeting the TSO-C80, paragraph 16.0, requirements using a minimum puncture force of 370 pounds.

(h) Each integral fuel tank must have provisions for inspection and repair of its interior.

[Doc. No. 5074, 29 FR 15695, Nov. 24, 1964, as amended by Amdt. 27-23, 53 FR 34213, Sept. 2, 1988; Amdt. 27-30, 59 FR 50387, Oct. 3, 1994]

**§ 27.965 Fuel tank tests.**

(a) Each fuel tank must be able to withstand the applicable pressure tests in this section without failure or leakage. If practicable, test pressures may be applied in a manner simulating the pressure distribution in service.

(b) Each conventional metal tank, nonmetallic tank with walls that are not supported by the rotorcraft structure, and integral tank must be subjected to a pressure of 3.5 p.s.i. unless the pressure developed during maximum limit acceleration or emergency deceleration with a full tank exceeds this value, in which case a hydrostatic head, or equivalent test, must be applied to duplicate the acceleration loads as far as possible. However, the pressure need not exceed 3.5 p.s.i. on surfaces not exposed to the acceleration loading.

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(c) Each nonmetallic tank with walls supported by the rotorcraft structure must be subjected to the following tests:

(1) A pressure test of at least 2.0 p.s.i. This test may be conducted on the tank alone in conjunction with the test specified in paragraph (c)(2) of this section.

(2) A pressure test, with the tank mounted in the rotorcraft structure, equal to the load developed by the reaction of the contents, with the tank full, during maximum limit acceleration or emergency deceleration. However, the pressure need not exceed 2.0 p.s.i. on surfaces not exposed to the acceleration loading.

(d) Each tank with large unsupported or unstiffened flat areas, or with other features whose failure or deformation could cause leakage, must be subjected to the following test or its equivalent:

(1) Each complete tank assembly and its support must be vibration tested while mounted to simulate the actual installation.

(2) The tank assembly must be vibrated for 25 hours while two-thirds full of any suitable fluid. The amplitude of vibration may not be less than one thirty-second of an inch, unless otherwise substantiated.

(3) The test frequency of vibration must be as follows:

(i) If no frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, the test frequency of vibration, in number of cycles per minute must, unless a frequency based on a more rational calculation is used, be the number obtained by averaging the maximum and minimum power-on engine speeds (r.p.m.) for reciprocating engine powered rotorcraft or 2,000 c.p.m. for turbine engine powered rotorcraft.

(ii) If only one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical, that frequency of vibration must be the test frequency.

(iii) If more than one frequency of vibration resulting from any r.p.m. within the normal operating range of engine or rotor system speeds is critical,

the most critical of these frequencies must be the test frequency.

(4) Under paragraphs (d)(3)(ii) and (iii) of this section, the time of test must be adjusted to accomplish the same number of vibration cycles as would be accomplished in 25 hours at the frequency specified in paragraph (d)(3)(i) of this section.

(5) During the test, the tank assembly must be rocked at the rate of 16 to 20 complete cycles per minute through an angle of 15 degrees on both sides of the horizontal (30 degrees total), about the most critical axis, for 25 hours. If motion about more than one axis is likely to be critical, the tank must be rocked about each critical axis for 12½ hours.

(Secs. 313(a), 601, and 603, 72 Stat. 752, 775, 49 U.S.C. 1354(a), 1421, and 1423; sec. 6(c), 49 U.S.C. 1655(c))

[Amdt. 27–12, 42 FR 15045, Mar. 17, 1977]

### § 27.967 Fuel tank installation.

(a) Each fuel tank must be supported so that tank loads are not concentrated on unsupported tank surfaces. In addition—

(1) There must be pads, if necessary, to prevent chafing between each tank and its supports;

(2) The padding must be non-absorbent or treated to prevent the absorption of fuel;

(3) If flexible tank liners are used, they must be supported so that it is not necessary for them to withstand fluid loads; and

(4) Each interior surface of tank compartments must be smooth and free of projections that could cause wear of the liner unless—

(i) There are means for protection of the liner at those points; or

(ii) The construction of the liner itself provides such protection.

(b) Any spaces adjacent to tank surfaces must be adequately ventilated to avoid accumulation of fuel or fumes in those spaces due to minor leakage. If the tank is in a sealed compartment, ventilation may be limited to drain holes that prevent clogging and excessive pressure resulting from altitude changes. If flexible tank liners are installed, the venting arrangement for the spaces between the liner and its